ESP-JETA
ESP Journal of Engineering & Technology Advancements
ISSN: 2583-2646 / Volume 2 Issue 2, April 2022 / Page No: 6-9
Paper Id: JETA-V2I2P102 / Doi: 10.56472/25832646/JETA-V2I2P102

Original Article

IoT Based Milk Monitoring System for the Detection of Milk Adulteration

Dr. P. Ganesh Kumar[1], A.Alagammai[2], B.S.Madhumitha[3], B.Ishwariya[4]
[1,2,3,4]*Department of Information Technology, K.L.N.College of Engineering, Pottapalayam, Sivaganga, Tamil Nadu, India.*

Abstract: *Adulteration is an intense issue that poses dangerous health problems to numerous in India. In every item there is degradation. Starting from the everyday food, it progresses toward the lifesaving prescriptions. The reprobates have not saved even infants milk things. The milk that is adulterated is harmful because it is toxic and it can affect the development and proper growth of human being. For perceiving the risky pieces of milk and consumables, the abstract spectroscopic technique is a prevalent decision. Every one of the known spectroscopic strategies for perceiving milk defilements are research center based and need expensive stuff. This lab based identification consumes quite a while and is expensive, which the regular individual will in all likelihood not be able to pay. To resolve this issue, the milk monitoring identification/checking framework utilizes sensors like pH, conductivity/impedance, and CO2 to anticipate bacterial development and milk weakening. In the real-time detection of milk adulterants, this proposed system implemented using Arduino UNO programmed with neural network classifier (Back Propagation Neural Network) for low cost and accurate milk adulteration testing.*

Keywords: *Back Propagation Neural Network, IoT, Milk Adulteration*

INTRODUCTION

Milk is one of the staple foods which is consumed all around the world for its nutritional value. Milk contains 3.3% protein, 5% lactose, 87% water and 3.9% fats. The unapproved expansion of cow milk to milk from different animals is one of the most widely recognized adulterations in the dairy industry. This isn't simply an issue of food quality and realness, yet in addition of consumer security for the individuals who are allergic to cow milk. Food adulteration is what is going on among shops today to produce more quick pay. Adulteration is used in meals for example, adding chalk powder to turmeric, starch to curry powder, blending papaya seeds with dark pepper, maturing mangoes etc. On a drawn out premise, this adulteration try has adverse results for people. India polishes off generally 77.68 million metric huge loads of liquid cow milk. Adulterants are regularly added to milk to broaden its timeframe of realistic usability. A few additives, like formalin and acid, are added to milk as adulterants, expanding the time span of usability of the item. Food quality, especially milk quality, should be firmly observed to guarantee food handling and human wellbeing. Therefore, the advancement of speedy, touchy, reliable, and savvy techniques and sensor frameworks for food quality observing and early discovery/ID of bacteria is basic. Pathogen distinguishing proof has arisen as the dairy business' top specialized need. Consumers and regulatory organizations can apply machine learning algorithms to analyze spectral data and provide helpful knowledge about milk composition quality

RELATED WORKS

Natarajan gave a survey paper on contaminated discovery in an assortment of food items. However the methodology further develops precision, there are a couple of issues that should be tended to all through the application's turn of events.

Amado et associates utilized AI strategies to fabricate forecast models for distinguishing the presence of microbes, for eg., E.coli and S.aureus in rough meat, and a while later used accuracy and cross-endorsement to close which model is wonderful. Random Forest (RF), Artificial Neural Network (ANN),Naïve Bayes Classifier (NB), K-Nearest Neighbors (KNN) and Support Vector Machine (SVM) are five AI techniques used in this audit (ANN).

Del et al. proposed a multi-full (twofold band) sensor that identifies milk corruption with water utilizing open ring resonators (SRR). The sensor utilizes a modern, logical, and clinical (ISM) band with double thunderous frequencies of 2.5GHz and 3.5GHz.A portion of the standard spectroscopic coupled chemometric apparatus investigation strategies are utilized by Natarajan et al to do subjective and quantitative examination on defilement recognition.

Ramakrishnan et al investigated the optical properties of p-NA functionalized AgNP for melamine corruption in milk disclosure.

Khairurrahman et al. presented ultrasonic wave transmission testing as a non-damaging, in-situ, and fast testing approach. A transmitter transducer makes unending ultrasonic floods of 1 MHz repeat, which are guided to the whole milk medium in a test cell with a actuator distance of 9.2 mm and got by a gatherer actuator facing each other.

Saravanan et al fostered a microcontroller-based framework for identifying and surveying milk attributes. The boundaries are milk sum, pH, CLR, and SNF. Various sensors are utilized to quantify these qualities. Ghodinde et al. found urea-tainted milk with differing rates of urea. Following affirmation of the recognition recurrence, the impact of contaminated level on opposition, impedance, and stage point is inspected utilizing the laid out approach.

Chakraborty et al. presented a coordinated milk-testing framework for identifying fat substance and defilements in milk simultaneously. A minuscule temperature control framework and an incorporated sign molding circuit for fat and corruption recognition make up the model. Bright et al. shown an IoT-based food and formalin identification framework that utilizations AI calculations to distinguish the presence of formalin. To perceive three citrus drinks, Trigoso et al used dielectric spectroscopy and four interesting grouping draws near KNN, SVM, Quadratic and Linear Discriminant.

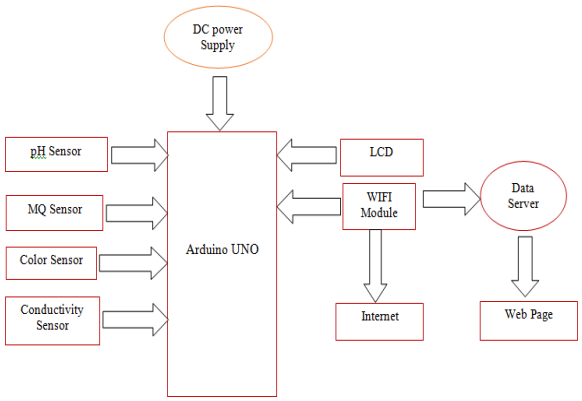
Sowmya et al. arranged and cultivated a low cost, flexible, AI-based, spectroscopic sensor system that can perceive milk contamination persistently.

PROPOSED METHODOLOGY

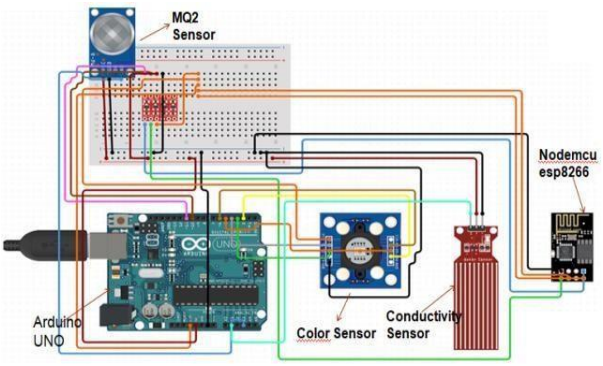
This record sums up the most fundamental and imperative examinations in the location of debased food, strikingly milk, utilizing sensors like CO2, conductivity, and pH level. These sensors are utilized to identify milk amount and quality. Microbial activity is settled using gas sensor, first rate milk should have no pungency, so pungency of the milk is assessed by using a pH sensor and moreover amount of water in milk is assessed by using a conductivity sensor. It is carried out utilizing Arduino regulator and it is customized with neural network classifier for minimal expense and exact milk defilement testing. Nature of milk is arranged utilizing Back Propagation Neural Network and the values are displayed in Thingspeak.

SYSTEM DESIGN

BLOCK DIAGRAM:



CIRCUIT DIAGRAM:



BACK PROPOGATION NEURAL NETWORK(BPN)

The BPN was presented in 1960 and afterward it was distributed by Ronald Williams, Geoffrey Hinton, David Rumelhart in the renowned 1986 paper. They explained the different neural networks and concluded that the training of the network is done by back propagation.BPN is widely used in training neural networks and computing the function of loss w.r.t the weights of network. It functions with multilayer neural networks and observes the internal representations of input-output mappings.

The BPN in neural networks processes the slant of the function of loss for a weight in line with rule of chain . It effectively processes layer by layer, in contrast to the native direct calculation. It computes the inclination, yet it doesn't characterize how to utilize the slope. It sums up the calculation in delta rule.

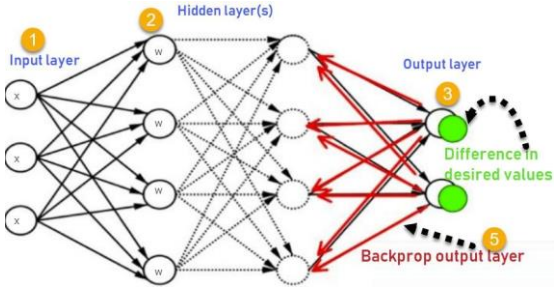


Figure 1 BPN Network Model

The design of the BPN is shown above in Figure 1 comprises of 3 layers. They are the i/p, hidden and o/p layer.

Input layer: It takes various input in different format provided by the programmer.

Hidden layer: It is between the i/p and o/p layer. It is utilized to perform estimations to recognize stowed away elements and examples. It computes the blunder got in the determined result.

Output layer: A progression of changes acted in the i/p layer utilizing hidden layer and the ideal outcome in the result layer.

Working of BPN:

1. Input X goes through a pre-associated way.
2. Input is displayed utilizing weights W. The weights are generally picked indiscriminately.
3. Calculate the result for every neuron from the i/p layer, to the hidden and result layer.
4. Calculate the blunder in the received yields. The mistake is determined by taking away the ideal result from the actual o/p.
5. Go back from yield layer to hidden layer to change weights to decrease errors.

Continue the process until wanted yield is reached.

HARDWARE DESCRIPTION:

Arduino UNO

Arduino UNO is an open-source h/w and s/w platform that uses basic equipment and programming to simplify it to use. Arduino UNO board can take i/p - like light sensor, a finger on button, or a Twitter tweet - and convert them to yields - like turning on a LED, setting off a motor, or posting anything on the web. An Atmel 8-digit AVR microcontroller (ATmega8, ATmega168, ATmega328, ATmega1280, or ATmega2560) with variable measures of flash memory, pins, and highlights is utilized in most Arduino controller.

MQ2 Sensor:

It uses the absorption of infrared light at a specific frequency to monitor and identify amount of carbon dioxide. The MQ2 sensor runs on 5V DC and consumes around 800mW. It has a conspicuous proof degree of 200 to 10000ppm for Hydrogen, Carbon Monoxide, LPG, Methane, Alcohol, Smoke and Propane.

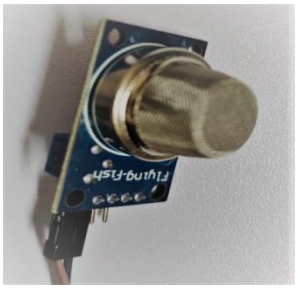


Figure 2 MQ2 Sensor

pH Sensor

A pH sensor is one of the fundamental bits of equipment for water testing. This sort of sensor can recognize causticity and alkalinity levels in water and various liquids. Most of pH terminal producers hold back nothing level of around 0.1 pH exactness. 0.1 is feasible on the off chance that the pH sensor is appropriately kept up with, alignments are performed properly, and capacity is finished by producer guidelines.

Figure 3 pH Sensor

Conductivity Sensor:

The limit of a water test to lead an electrical flow is estimated utilizing conductivity sensors. Unadulterated water is a poor conduct of electricity, yet adding ions from broke down salts and inorganic components like soluble bases, chlorides, sulphides, and carbonate compounds upgrades an example's conductivity, making conductivity a huge water quality indicator.

RESULT:

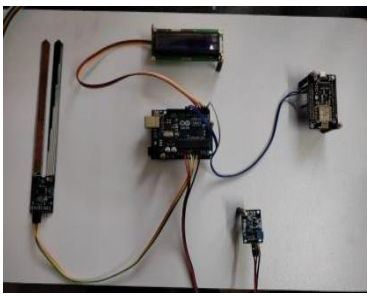


Figure 4 Connections

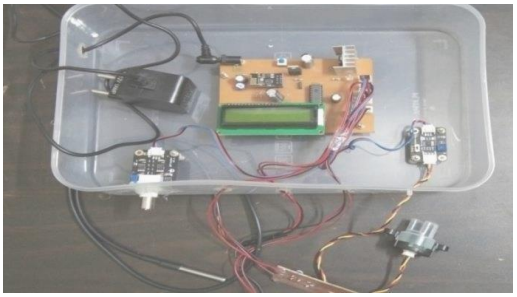


Figure 5 Detection of Milk Adulteration

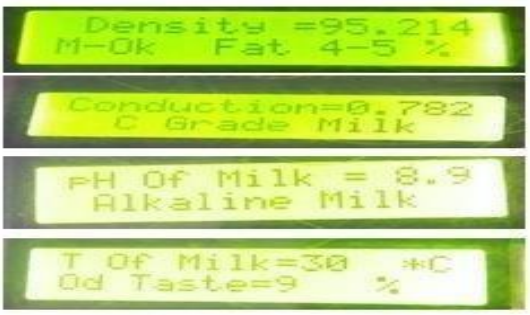


Figure 6 Values from the Sensor

CONCLUSION

The suggested innovation uses a sensor-based BPN model to recognize contaminated in light of information. It is a strategy for preparing the loads of neuralnet based on mistake acquired in past cycle. For food quality noticing and location, the framework's show is achieved using quick, fragile, reliable , savvy approaches and sensor framework.

REFERENCES

[1] N. Sowmya and V. Ponnusamy, Development of Spectroscopic Sensor System for an IoT Application of Adulteration Identification on Milk Using Machine Learning, in IEEE Access, 9 (2021) 53979-53995, doi: 10.1109/ACCESS.2021.3070558.

[2] T. C. Trigoso, J. O. Cruz, H. A. Miñano and W. C. Silupu, Application of Machine Learning in the Discrimination of Citrus Fruit Juices: Uses of Dielectric Spectroscopy, 2020 IEEE Engineering International Research Conference (EIRCON), (2020) 1-4. doi: 10.1109/EIRCON51178.2020.9253756.

[3] S. P. S. Brighty, G. S. Harini and N. Vishal, Detection of Adulteration in Fruits Using Machine Learning, 2021 Sixth International Conference on Wireless Communications, Signal Processing and Networking (WiSPNET), (2021) 37-40. doi: 10.1109/WiSPNET51692.2021.9419402.

[4] M. Chakraborty and K. Biswas, Milk Tester: Simultaneous Detection of Fat Content and Adulteration, in IEEE Transactions on Instrumentation and Measurement, 69(5) (2020) 2468-2476, doi:10.1109/TIM.2019.2955796.

[5] K. A. Ghodinde and U. M. Chaskar, Quantification of Urea Adulteration with Impedance Spectroscopy in Cow Milk, 2021 6th International Conference for Convergence in Technology (I2CT), (2021) 1-5. doi: 10.1109/I2CT51068.2021.9418154.

[6] S. Saravanan, K. M, K. N S, K. N S and N. V I, Smart Milk Quality Analysis and Grading Using IoT, 2021 5th International Conference on Intelligent Computing and Control Systems (ICICCS), (2021) 378-383. doi: 10.1109/ICICCS51141.2021.9432298.

[7] A. A. Khairurrahman, B. M. Wibawa and D. Hidayat, The Evaluation of Adulteration in Milk Using The Propagation of Ultrasonic Waves, 2021 International Conference on Artificial Intelligence and Mechatronics Systems (AIMS), (2021) 1-4, doi: 10.1109/AIMS52415.2021.9466070.

[8] K. Ramakrishnan, S. Singaram, D. Thiyagarajan and S. V. Srinivasan, Design and Development of Electro-Optic System for Quantification of Melamine Concentration in Milk, in IEEE Transactions on Nanotechnology, 20(2021) 810-817, doi: 10.1109/TNANO.2021.3123175.

[9] S. Natarajan and V. Ponusamy, A Review on Quantitative Adulteration Detection in Milk, 2021 Smart Technologies, Communication and Robotics (STCR),2021,pp.14,doi:10.1109/STCR51658.2021.9588800.P. Del Carpio-Concha, A. Nuñez-Flores, R. Acosta-Araníbar and P. Castillo-Araníbar, Microwave Sensor Based on Split Ring Resonators for Dielectric Characterization of Density and Viscosity of Milk, 2020 IEEE MTT-S Latin America Microwave Conference (LAMC 2020), (2021) 1-4. doi: 10.1109/LAMC50424.2021.9601580.

[10] T. M. Amado et al., Development of Predictive Models using Machine Learning Algorithms for Food Adulterants Bacteria Detection, 2019 IEEE 11th International Conference on Humanoid, Nanotechnology, Information Technology, Communication and Control, Environment, and Management (HNICEM), (2019)1-6. doi: 10.1109/HNICEM48295.2019.9072907.